



BULLETIN 812

FEBRUARY 1951

no abs



1951 SPRAY SCHEDULES *for Tree Fruits*

By W. D. Mills and A. A. LaPlante

Cornell Extension Bulletin

1951 Spray Schedule for Tree Fruits

W. D. MILLS AND A. A. LAPLANTE

THE important facts concerning the practical control of orchard diseases and insects by spraying and dusting under New York conditions are given in this bulletin. Only spray schedules based on the latest published and unpublished data of the research workers of the state experi-

ment stations and the authors' observations of practices followed by successful fruit growers are given. It has been prepared after conferences with the members of the experiment stations at Geneva and Ithaca.

APPLES

THE MOST important problems are apple scab, codling moth, apple maggot, plum curculio, red-banded leaf roller, orchard mites, and rosy aphid. Occasionally, cedar rusts, the fruit tree leaf roller, the scurfy scale, apple red bugs, and the green aphid become of major importance either locally or generally throughout the region. Other diseases and insects are restricted in importance to more or less definite areas. Because of these variations

in importance of the different insects and diseases with locality and year, the following schedule must be considered as a general outline of the spray program to be modified to meet the actual conditions in the orchards to be treated. In counties where the Extension Service conducts a spray-information service, valuable assistance in adapting the general recommendations to individual needs may be obtained on request.

SPRAY OUTLINE

FALL AND WINTER APPLICATIONS

Recent investigations show fall and winter sprays of DNC¹ materials are as effective as the use of those products in the spring for the control of rosy apple aphid and eye-spotted bud moth. To control rosy aphid with fall applications of these materials, use 1½ quarts of the liquid or 1½ pounds of the powder form to make 100 gallons of spray. For control of bud moth, use 3 quarts of liquid or 3 pounds of powder in each 100 gallons of water for light to moderate infestations and 4 quarts and 4 pounds respectively for heavy infestations. For best

results and for maximum safety to the trees, apply the sprays after the leaves have dropped.

Fall applications for rosy-aphid control should not be made until after the temperature drops to about 20°F., or below, for a number of hours, because observations indicate that egg laying does not stop in the fall until these temperatures have been reached. It has not been fully proved whether fall applications will effectively control oyster shell scale, but they may be tried in light infestations.

The recently introduced DNBP² materials (Elgetol 318, DN 289) are not recom-

¹DNC contains dinitro ortho cresol. Sold in liquid and powder form in New York State as Elgetol, Krenite, DN Dry Mix No. 2, Dinitro Dry, Ortazol Powder, and the like.

²DNBP contains dinitro secondary butyl phenol.

mended for fall applications. They are more injurious than the DN materials previously used. Experience indicates that injury may result if fall applications are made.

Regular dinitro sprays may be made

any time during the winter when temperatures are above freezing and the spray is permitted to dry without freezing. Oil sprays should not be applied until March or April since injury may result.

SPRING APPLICATIONS

Dormant Spray

(*After the buds have begun to swell but before they show green at the tip*)

When control measures are necessary for rosy, green, or apple aphids, oystershell scale, or bud moth, the DN, or dinitro, spray materials are recommended.

For the control of rosy and green aphids, use liquid DNC at a rate of $1\frac{1}{2}$ quarts in 100 gallons of water. Powders containing 40 per cent dinitro-orthocresol should be used at the rate of $1\frac{1}{2}$ pounds in 100 gallons of water. For the control of light to moderate infestations of oystershell or bud moth, use 3 quarts of liquid, or 3 pounds of powdered DNC in 100 gallons of water. In severe infestations, it may be desirable to increase the dosage to 4 quarts, or 4 pounds of dinitro in 100 gallons of water. Trees in some orchards have been injured when DNC compounds have been incorporated with petroleum oil. Therefore, if a dormant application of oil is necessary, apply it after a rain has washed most of the DNC material from the tree. For the control of red bug, fruit tree leaf roller, or scurfy scale, use "superior" type dormant oil spray in the green-tip or delayed-dormant stages when DNC materials are used in the dormant period.

If you do not use the dinitro materials to control rosy and green aphid, oystershell scale, or bud moth in the dormant period, make an application of a dormant type oil at this time. Dormant oil sprays are used at varying concentrations depending on the insect to be controlled. For leaf roller, scurfy scale, and red bug, a 3 per cent concentration of oil is required and the application may be made in the green-tip or delayed-dormant stages. A 2 per cent

"superior" dormant oil is required to kill European red mite. Best control of European red mite is obtained when the applications are made in the green-tip or delayed-dormant stage. A 2 per cent concentration of a "superior" dormant oil emulsion provides satisfactory control of San José scale.

Satisfactory results have been obtained by emulsifying oil sprays in the spray tank. A suitable emulsifier is blood albumin used at the rate of 2 ounces of actual blood albumin to 100 gallons of the spray mixture. Use only blood albumin that is soluble in water. Those that form only a temporary suspension and settle to the bottom after being shaken vigorously in a container of water are unsatisfactory. Suitable commercial brands that contain 2 ounces of actual blood albumin in $\frac{1}{2}$ pound of finished product are available.

The newer dinitro materials (DNBP) are equally as effective as the older DN materials against aphids, bud moth, and scale insects. These materials are known to growers as DN-289 and Elgetol 318. In addition to being effective against pests controlled by the DNC materials they are also effective against scurfy scale and San José scale. These materials are effective at lower concentrations than regular dinitros and likewise are more likely to cause injury to buds if used later than dormant stage of bud development. These materials are not recommended for fall application. Concentrations should be used as follows:

Aphids 1 quart in 100 gallons
Bud moth 2 quarts in 100 gallons

*Scale insects 2 quarts in 100 gallons

European

red mite 2 quarts in 100 gallons

*Oystershell scale requires 3 to 4 quarts.

DNBP materials are also toxic to the overwintering eggs of the European red mite. However, experience has shown that mite populations built up more rapidly during the summer with DNBP materials as compared with applications of dormant oil. It is therefore suggested that the DNBP materials not be depended upon as a dormant control for overwintering eggs of European red mite. Where European red mite populations have been high the past summer or where a heavy deposit of overwintering eggs is present in the orchard, it is suggested that oil be used preferably in the green-tip or delayed-dormant application as an early red-mite control measure.

Green-tip spray

(When the leaves of the blossom buds are bursting and show from $\frac{1}{8}$ to $\frac{1}{4}$ inch of green color)

The green-tip spray is suggested in large orchards where it has been impossible to complete the dormant application or where it has been difficult to complete the spray in the time permitted at the regular delayed-dormant stage. In the past several years it has been customary to include recommendations for both "regular" type dormant oil and "superior" type dormant oil in the Extension Service recommendations. Inasmuch as the "superior" type oils are more efficient and allow a greater margin of safety to the trees, the 1951 recommendations refer only to the "superior" type oils. A 3 per cent "superior" dormant oil at this time controls leaf roller, red bug, and scurfy scale. A 2 per cent dormant oil controls European red mites as well as San José scale. Bordeaux mixture helps to prevent early apple scab infection.

Bordeaux mixture is usually added for protection against early scab infection. It is preferable to emulsify the oil with blood albumin and then to add the 2 pounds of powdered copper sulfate and 4 pounds of lime to form the bordeaux mixture rather than to emulsify the oil with the bordeaux mixture.

Bordeaux mixture	2-4-100
"Superior" type oil	2 gallons*
Blood albumin	2 ounces
Water to make.....	100 gallons

*2 gallons controls red mite and San José scale. For red bug, leaf roller and scurfy scale, increase to 3 gallons.

If you made no dormant application of dinitro material, you may add 1 pint of nicotine sulfate to this spray for the control of aphids and bud moth with poorer results. For commercial control of both aphids and bud moth and for good control of bud moth, make this application when the buds are showing full green tips and during that period when the aphid eggs are not all hatched. If the spray is applied too early, the effectiveness of the treatment against aphids usually is not satisfactory.

Delayed-dormant spray

(When the leaves of the blossom buds are out from $\frac{1}{4}$ to $\frac{1}{2}$ inch)

Bordeaux mixture	2-4-100
"Superior" type oil	2 to 3 gallons
Blood albumin	2 ounces
Water to make	100 gallons

or

Lime-sulfur	2 gallons
or	

Elemental sulfur at manufacturers' directions

Water to make	100 gallons
---------------------	-------------

An oil spray may be used at this time to kill over-wintering red-mite eggs. The bordeaux-oil formula is used when control of both apple scab and red mite are desired. Many growers using an oil at this time will find it desirable to use a 3 per cent "superior" oil which will control red bug, leaf roller, and scurfy scale in addition to European red mite and San José scale. A 2 per cent "superior" oil emulsion is effective against red mite and San José scale. The sulfur formula is used and timed primarily for the control of apple scab. Your choice should be determined by the insects to be controlled and the materials you have already applied in the dormant and green-tip sprays.

To prevent possible spray injury if the bordeaux-oil formula is used, complete the delayed-dormant spray before the leaves roll back and expose the blossom buds.

If you use the bordeaux-oil formula and casebearers, tent caterpillars, and other chewing insects are a problem, you may include 3 pounds of lead arsenate. Do not use DDT with the oil formula. Three pounds of hydrated lime included in the mixture tends to reduce the danger of arsenical injury. If you use the sulfur formula, either 2 pounds of 50 per cent wettable DDT powder or lead arsenate may be used. Do not use lead arsenate or DDT unless it is necessary to control insects because residues on the ground cover and leaves frequently cause serious mortality to wild pollinating insects and to honeybees.

If you applied no sprays earlier to control aphids, you may add 1 pint of nicotine sulfate. For nicotine spray to be most effective against the rosy aphid, it is necessary to delay spraying until nearly all the eggs have hatched. Under normal weather conditions this has taken place by the time the opening leaves have reached the stage indicated, and that is usually early enough for scab control. In exceptional seasons, however, apple-scab infection may occur before the aphid eggs have hatched. Under such circumstances bordeaux mixture in the green-tip application, or an additional early application of 2 gallons of lime-sulfur or elemental sulfur may be required to control scab before the delayed-dormant spray and followed later, when the aphids have hatched, by the application of lime-sulfur or elemental sulfur and nicotine.

Pre-blossom sprays

Lime-sulfur 2 gallons

OR

Elemental sulfur at manufacturers' directions

Water to make 100 gallons

The pre-blossom spray or sprays, applied between the delayed-dormant spray and

the bloom, are timed primarily for scab control. The points to be considered in timing the applications are: the occurrence of rain periods, the amount of new growth, and the stage of development of the scab fungus. In some seasons two pre-blossom applications may be required for effective scab control, especially on extremely susceptible varieties such as McIntosh.

Dusting or spraying with elemental sulfurs during rain may be a valuable aid in scab control. Both are effective if properly applied. The paste sulfurs are especially valuable for sprays during rain, but the dry wettable sulfurs may also be used. The addition of 1 pound of hydrated lime increases the effectiveness of both forms. An oil type of sticker increases the deposit of sulfur during a rain, but the paste sulfurs give excellent control at from 10 to 12 pounds in 100 gallons of spray without a sticker. Sulfur dusts are effective also during rain, but usually an application must be repeated for protection through the next rain. The finest divided dusts are most effective and the addition of wetters or stickers to the dusts has not been shown to increase effectiveness. The effective use of these materials during rain is discussed in Cornell Extension Bulletin 630, *Efficient Use of Sulfur Dusts and Sprays during Rain to Control Apple Scab*.

For after-rain sprays, lime-sulfur may be used on dry foliage but is too injurious to blossoms and set to use during bloom. The phenyl mercury compounds Tag and Puratized Apple Spray have given the most consistent performance of the organics in after-rain sprays for scab control. Limited evidence indicates these materials may be used in bloom without serious effects on fruit set or on honeybees. Both lime-sulfur and the phenyl mercury sprays may cause severe foliage and fruit injury if applied during or just before periods of intense heat. Fruit injury may, however, occur and there is danger of mercurial residues if applied after bloom.

If chewing insects, such as fruit tree leaf roller or green fruitworms, present a seri-

ous threat to the foliage or buds, you may include 2 pounds of 50 per cent wettable DDT powder in the pre-blossom spray. Generally, unless the threat is serious, growers will find it advisable to postpone the use of DDT until petal-fall spray to reduce possible danger to pollinating insects. Lead arsenate should not be used in this spray because it poisons pollinating insects. If an insecticide is to be used in this spray, honeybees must be removed from the neighborhood.

Special bloom spray

(When three-fourths of the blossoms are open in orchards where fire blight is a problem)

Copper sulfate	2 pounds
Hydrated lime	6 pounds
Water to make	100 gallons
<i>or</i>	
20-20 copper-lime dust	

One application is usually made when three-fourths of the blossoms are open but, if the disease has been very severe, you may make an additional early application when about one-fifth of the blossoms are open. The possibility of a reduction of the set of fruit and of fruit russetting by applications of copper during bloom should be balanced against the likelihood of blossom infection in deciding whether to apply the material in individual orchards.

Blight was serious in a number of apple orchards in 1946 and 1947. A bloom spray in these orchards should help to control the blight.

The spray application is supplementary to such measures as chemical treatment or cutting out of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit-spurs.

Bloom sprays and dusts of elemental sulfur may be of considerable value in orchards where cedar rusts are a problem and where eradication of the red cedar is impracticable.

An organic compound, ferric dimethyl-dithiocarbamate, sold under the name of Ferham, has been shown in Hudson Valley experiments to be much more efficient than sulfur in the control of cedar rust. Where the rusts are serious in the Hudson Valley, the use of $\frac{1}{2}$ pound of this organic compound, with 3 pounds of elemental sulfur in 100 gallons of spray, is suggested for the pre-bloom spray, in a bloom spray, and in the petal-fall and curculio sprays.

Special bloom sprays usually are not needed to control apple scab. However, in orchards that received the pre-blossom spray sometime in advance of the opening of the blossoms or where the pre-blossom spray was omitted, or in seasons when the bloom period is unusually long and rainy, bloom applications of elemental sulfur may be valuable aids in scab control. Yield, however, may be reduced by these bloom applications, and their use is justified only when the amount of bloom and pollinating conditions are adequate and a disease problem exists. Insecticides should not be included in any bloom application.

Petal-fall spray

(When the last of the petals are falling)

Before you apply a petal-fall spray, remove honeybees from the orchard and place them at least one mile away.

Lime-sulfur	2 gallons
-------------------	-----------

or
Elemental sulfur at manufacturers' directions

Lead arsenate	3 pounds
Hydrated lime	3 pounds

The lead arsenate in this spray should give adequate protection against plum curculio in most western New York orchards. The hydrated lime is included as a protection against arsenical injury. If you omitted the dormant oil, you may include 2 pounds of DDT where fruit-tree leaf roller and red bud are of importance, and drop the concentration of lead arsenate and lime to 2 pounds of each. The combi-

nation of DDT and lead arsenate affords more protection against plum curculio than does lead arsenate alone and is of some value against the red-banded leaf roller.

If plum curculio is a serious problem, as in many eastern New York orchards, you may substitute 3 pounds of methoxychlor 50 per cent wettable powder or 2 pounds of 15 per cent parathion for the lead arsenate and lime. Do not use parathion on McIntosh and varieties with McIntosh parentage. Parathion presumably has the same effect on fruit-tree leaf roller and red bug as DDT and in addition affords protection against any orchard mites present at this time. Methoxychlor apparently has little value against pests other than plum curculio. With the exception of lead arsenate, none of the above materials should be used with lime-sulfur as their effectiveness will be seriously reduced.

If wet weather prevails during bloom and if scab control is doubtful, or if scab spots are present on the leaves, you may use lime-sulfur. With dry weather during bloom and no scab present, elemental sulfur is preferred for the petal-fall spray to lessen the danger of spray injury and of reduction in yield by lime-sulfur.

If conditions are favorable for a heavy infection of scab, spray as much as possible and use dust as a supplementary measure.

Curculio or special scab spray

(From one to two weeks after the petal-fall spray)

Lime-sulfur	2 gallons
or	
Elemental sulfur at manu-	
facturers' directions	
Lead arsenate	3 pounds
Hydrated lime	3 pounds

In eastern New York this spray is timed primarily for plum curculio but it is important also for the control of apple scab. The spray is usually applied in that area from seven to ten days after the petal-fall spray. To control plum curculio, your choice of material to use is the same as for the petal-fall spray.

This plum-curculio spray, particularly in many western New York orchards, is important for red-banded leaf roller. In orchards where this pest has been active, you may add DDD powder at 1 pound or DDD emulsion at 1 quart to the lead arsenate in the formula. Thoroughly cover the undersides of the leaves and reduce the hydrated lime to 2 pounds.

Parathion is effective against the red-banded leafroller as well as the plum curculio and may be used without other insecticides except on McIntosh and related varieties. One pound of parathion should be enough to control red-banded leaf roller if you thoroughly cover the undersides of the leaves. For combined protection against the leaf roller and plum curculio, use 2 pounds. Parathion also helps to control orchard mites. Methoxychlor alone is of little value against red-banded leafroller, and DDD is ineffective against curculio. Combine these materials where both pests are a problem.

In western New York orchards in many seasons, a special spray, applied about two weeks after the petal-fall spray, may be required to control apple scab.

The same considerations exist as in the petal-fall application with respect to the choice of elemental sulfur or liquid lime-sulfur in this application.

SUMMER SPRAYS

The purpose of the summer sprays is to control codling moth, apple maggot, red-banded leaf roller, and apple scab. Orchard mites and the green apple aphid may also become problems.

It is the usual practice to include a fungicide in all of the summer sprays for scab control. If you have had good control, it is advisable to use one of the 325-mesh elemental sulfurs as a fungicide in the summer applications to reduce the danger of injury to foliage and fruit. When scab is not a problem, you may omit the fungicide from some of the summer sprays during or preceding hot periods. A fungicide should, however, be included in the last summer application unless a thorough examination of the trees, especially in the tops, shows scab is not a problem. The coarser 325-mesh dry wettable sulfurs are inferior to the finer sulfurs early in the season but are adequate for scab control in the summer. The 325-mesh sulfur causes much less sulfur-sun scald to the fruit during hot periods than do the more finely divided pastes or dry wettable sulfurs.

The summer-spray program of sulfur and lead arsenate usually controls Brooks fruit-spot. Small amounts of this disease appeared on susceptible varieties of apples in the Hudson Valley in 1947. In this area 1 pound of Ferbam may be substituted for the sulfur when lead arsenate is not used.

In planning a spraying schedule for the summer applications—that is, after the petal-fall or the curculio spray—it must be kept in mind that the regulations of the Federal Food and Drug Administration do not permit excessive amounts of spray residue on the fruit at harvest time. The present tolerances permitted on apples and pears are 0.05 grain of DDT, 0.025 grain of arsenic trioxide, and 0.05 grain of lead for each pound of fruit. The tolerances on fruits other than apples and pears are 0.01 grain of arsenic trioxide and 0.025 grain of

lead for each pound of fruit. The equivalent unofficial tolerances for apples and pears expressed in parts per million (p.p.m.) would be 7 p.p.m. of DDT, 3.5 p.p.m. of arsenic trioxide, 7 p.p.m. of lead. For fruits other than apples and pears, the unofficial tolerances would be 1.5 p.p.m. of arsenic trioxide and 3.5 p.p.m. of lead.

The basic summer schedule follows: Suggested spray dates may be somewhat earlier in eastern New York and later in western New York than those indicated.

First codling-moth cover spray

(About June 10 to 15)

Elemental sulfur at manufacturers' directions

or

*Lime-sulfur 2 gallons
(if scab is a problem)

DDT 2 pounds
(50 per cent wettable powder)

Water to make 100 gallons

*DDT and lime-sulfur should not be used together.

The first codling-moth cover spray is timed primarily for codling moth. DDT should be used as a basic schedule in orchards with a moderate to heavy infestation of codling moth. Three pounds of lead arsenate and an equal quantity of hydrated lime as a corrective may be used as a basic schedule in orchards where little difficulty has been experienced with this insect in the past.

In eastern New York orchards, an insecticide should be included with the DDT for plum curculio control in this spray as discussed for the petal-fall spray. If you use parathion, you may omit the DDT. Parathion at 1½ pounds in 100 gallons is required for control of codling moth and 2 pounds are necessary for plum curculio. DDT may be omitted if methoxychlor is used for plum-curculio control.

Second codling-moth cover spray or first apple-maggot spray

(About June 20 to 28)

Elemental sulfur at manufacturers' directions

or

*Lime-sulfur 2 gallons
(if scab is a problem)

DDT 2 pounds
(50 per cent wettable powder)

Water to make 100 gallons

*DDT and lime-sulfur should not be used together.

Apply this spray from 10 to 14 days after the first cover spray, depending upon the severity of the codling-moth infestation. This spray may also be effective for the control of apple maggot.

Examine the trees carefully before you apply this and following sprays, to determine whether or not European red mites or two-spotted spider mites are building up. If you find from 4 to 6 mites generally on leaves in June, July, or early August, use tetraethyl pyrophosphate (TEPP) at manufacturers' directions, either added to the spray mixture or supplied as a separate spray. Parathion at 1 pound of 15 per cent wettable powder per 100 gallons of spray mixture may also be used on varieties other than McIntosh and Cortland. Fruit injury may result if used on these varieties. One and one-quarter pounds of DN-111 in 100 gallons or D-4 dust may be used as in the past but foliage and fruit injury may result if used at or before periods of high temperature. This injury is intensified where sulfur is used in the spray mixture. Two sprays are generally necessary since none of these materials are very toxic to the eggs. TEPP, DN-111 or D-4 dust should not be used with bordeaux mixture or lime.

Infestations of two-spotted spider mites seldom begin to build up before August but may continue to build up through harvest time. The same control measures suggested for European red mites control two-spotted spider mites, but two applications may not be enough.

Tetraethyl pyrophosphate at manufacturers' directions, or parathion at 1 pound of 15 per cent powder, may be included as a summer control for green apple aphids when they appear. The parathion should not be used on McIntosh and Cortland varieties.

Do not use summer oils with DDT because of the danger of burning the foliage and because toxic residue is greatly increased at harvest time.

If scab is under control, the sulfur can be eliminated from this spray. In light infestations where lead arsenate is to be used in the third cover spray and if scab is under control after the first cover spray, you may omit the sulfur in some of the other cover sprays; the omission is advisable during or preceding periods of extreme heat. Some growers prefer to use a 2-8-100 bordeaux mixture as the fungicide in this and later sprays. This mixture is superior to proprietary copper sprays in scab control, and is helpful in reducing arsenical injury. The bordeaux is reduced to a $\frac{3}{4}$ -3-100 concentration where scab control is not needed but arsenical injury is a problem. The use on apples of any copper compound now known is attended with some danger of injury to foliage and fruit in this State. The most dangerous period is from the delayed-dormant spray through the first cover spray. Any of the later sprays also may be injurious. It may be best also to lengthen the interval between applications from 12 days to 14 days.

Third codling-moth cover spray or second apple-maggot spray

(About July 2 to 10)

Elemental sulfur at manufacturers' directions

or

*Lime-sulfur 2 gallons
(if scab is a problem)

DDT 2 pounds
(50 per cent wettable powder)

Water to make 100 gallons

*DDT and lime-sulfur should not be used together.

This formula is effective for the control of codling moth, apple maggot, and apple scab. If apple scab is not a problem, you may omit the sulfur from this spray. Watch the orchard carefully for mites and, if a problem, follow the suggestions in the second codling-moth cover spray (page 9).

In light infestations of codling moth, 3 pounds of lead arsenate and 3 pounds of hydrated lime in 100 gallons of water may be used. If scab is a problem, sulfur may be added to the spray.

Fourth codling-moth cover spray or third apple-maggot spray

(About July 12 to 18)

Fungicide at manu-
facturers' directions

DDT	2 pounds (50 per cent wettable powder)
Water to make	100 gallons

This spray is effective for the control of codling moth and apple maggot. It may not always be necessary for the control of codling moth, depending on the seasonal development of this insect. When a DDT schedule is used for the control of apple maggot, this application is necessary because two applications of DDT are not so effective for the control of apple maggot as is lead arsenate, and apple maggot usually is at its peak of activity at this time. If a mite infestation is present, follow the suggestions made under the second codling-moth cover spray concerning the presence and control of mites (page 9).

The fungicide may be omitted from this application if apple scab is under control.

If you do not use the DDT program, put 3 pounds of lead arsenate and 3 pounds of hydrated lime in this application in place of the DDT. If you follow the lead-arsenate schedule, this serves as the second apple maggot spray instead of the third apple-maggot spray when DDT is employed. For a spreader at this time,

you may use $\frac{1}{4}$ pound of skimmilk powder or $\frac{1}{2}$ pound of soybean flour with the lead-arsenate program. Where arsenical injury is a problem, you may add 2 pounds of hydrated lime for each pound of lead arsenate. A $\frac{1}{4}$ -3-100 bordeaux mixture is more effective in this respect than is lime alone.

The nicotine compounds, parathion and TEPP, are apparently not effective against apple maggot. To control apple maggot satisfactorily, thoroughly spray all trees in infested orchards. This applies not only to apple trees in their off-bearing year, but also to other fruits interplanted with apples. Experience has shown that failures to control the apple maggot are especially likely to result if spraying is confined to trees with fruit. Hedgerows, neglected orchards, and scattered trees near and adjoining commercial plantings should also receive the maggot sprays.

Second brood codling-moth cover sprays

(First three weeks in August)

Fungicide at manu-
facturers' directions

DDT	2 pounds (50 per cent wettable powder)
Water to make	100 gallons

If you have used the DDT schedule to control the first-brood codling moth, it may not always be necessary to apply a second-brood spray to control codling-moth. The most common reason for not obtaining good codling-moth control has, however, been the failure to use second-brood sprays. Apply this spray when second-brood worm activity starts late in July or early in August.

In years of late fly emergence, or where flies migrate from adjoining unsprayed orchards or woodlots, this cover spray may be necessary to control apple maggot. It might be well to bear in mind that a DDT or DDD application controls apple maggot

for a period of about 10 days under average conditions, while lead arsenate is effective for about 18 days. If more than one second-brood DDT spray seems desirable, reduce the amount of DDT in each spray from 2 pounds of 50 per cent DDT wettable powder to 1 pound of DDT to 100 gallons of spray. Never apply DDT sprays within two weeks of harvest, and a three-week interval is preferable to prevent both toxic and visible residues. Use no more than two cover sprays at the recommended dosage because of the danger of exceeding the tolerance on toxic residue at harvest time. Usually the first second-brood cover spray should be applied during the first week of August and the second spray between August 12 and 20.

A second brood of red-banded leaf roller may appear late in July or early August. This brood can be controlled through the use of DDD, arsenate of lead, or parathion. The choice of material to use at this time depends on the other pests to be considered.

If red-banded leaf roller is the only problem, use DDD at the rate of 1½ pounds of 50 per cent wettable powder per 100 gallons of spray. In severe infesta-

tions two applications are needed, the first about July 25 and the second August 10. These dates may vary slightly from year to year.

Where aphids and mites are also present, parathion is preferred at the rate of 1½ pounds of 15 per cent wettable powder on varieties other than McIntosh and Cortland. Two applications may be required as mentioned above.

Where second-brood red-banded leaf roller and codling moth are both problems, it is suggested that DDD or parathion be used in the first week of August application and that DDT be used in the August 12 to 20 application.

Arsenate of lead when used at 3 pounds per 100 gallons is also effective against second brood of red-banded leaf roller. This program would also insure protection against late emerging apple maggot flies.

In light codling-moth infestations, or where first-brood control is excellent, second-brood sprays probably will not be required.

If a mite infestation is present, follow the suggestions made under the second codling-moth cover spray concerning the presence and control of mites (page 9).

DUSTING FOR CODLING MOTH, APPLE MAGGOT, AND APPLE SCAB

RECENT experiments and growers' experiences with DDT dusts indicate a promising future for the use of dusts in the control of codling moth. Although DDT dust programs provide better control of codling moth than can be obtained with the standard lead-arsenate spray program, they are not so effective as the DDT spray program. At present it does not seem advisable for growers who had a serious codling-moth or apple-maggot problem to switch now to a complete DDT dust program before adopting a DDT

spray schedule. Until more information is available concerning the use of dusts, limit the use of a DDT dust to supplement the regular DDT spray schedule in the heavier infested areas. You might, however, use a DDT dust to excellent advantage for the second-brood codling moth because of its very low toxic residue at harvest time, or to combat late activity of apple maggot. If, because of labor shortages or other conditions, you do consider a dusting program, the severity of the insect infestation, the equipment, the frequency of quiet at-

mospheric conditions and heavy dews in the locality are important.

In light to moderate infestations of codling moth or apple maggot, you may use a 5 per cent DDT dust with excellent results. Usually, five dust applications will be needed to control first-brood codling moth and two applications to control second-brood moths.

Successful utilization of a dusting program requires more than the use of DDT. It requires the use of adequate dusting equipment, thoroughness of applications, and great care in the selection of ideal

conditions for application. If possible, apply the dust when the foliage and fruit are wet with dew or rain. Be careful to maintain an adequate deposit. This may mean repeating an application within a few days if there are heavy rains.

For scab control, experimental work shows sulfur dusts are most effective when applied during rain before infection occurs. The finer divided dusts are more adherent than the coarser forms. Insist on having a dusting sulfur equal in fineness to the dry wettable sulfur even if you have to pay a little more for it.

PEAR

A PRACTICAL spray schedule for pears in New York must be built around the control measures required for pear psylla, for this pest is by far the most serious of any to the pear crop. The pear tarnished plant bug, pear midge, stink bug, fruit-tree leaf roller, green fruit-worms, sinuate pear borer, rose leaf beetle, and quince curculio cause damage in some

orchards. The most important disease of pears is fire blight, but pear scab, sooty blotch, leaf spot, and Fabraea leaf-blight and fruit spot are important in some orchards. The spray schedule includes sprays for all these. All growers do not have to apply all of the sprays. Select from the schedule those sprays needed to protect your particular orchard.

SPRAY OUTLINE

The choice of control measures for pear psylla depends upon the availability of materials and upon the experience of the individual grower as to other insect prob-

lems in his orchard. A basic schedule consists of either the dormant oil or a "green-tip" application followed by one or more of the later sprays if necessary.

SPRING APPLICATIONS

Dormant spray

(Early in the spring, the flies appear on the twigs and are ready to lay eggs and when the buds are not yet showing green)

*Superior dormant oil....	3 gallons
Blood albumin (actual)	2 ounces
Water to make	100 gallons

*Three gallons controls pear psylla, blister mite, fruit tree leaf roller and scurfy scale. Two gallons is enough for San José scale.

One pint of nicotine sulfate is added to the oil or used separately if pear thrips are a problem. Make the application when the thrips are "swarming" on the opening buds.

Green-tip spray

($\frac{1}{4}$ to $\frac{1}{2}$ inch of green showing)

Elgetol, Krenite, or Dinitrosol (DNC materials), 1 gallon in 100 gallons of spray, applied in the green-tip stage controls both pear psylla and sooty blotch. If sooty blotch is not a problem, you may use either 2 quarts or 2 pounds of a DNC material in this spray to kill pear-psylla eggs. The new DNBP materials DN-289 or Elgetol-318 may be used against psylla eggs at concentrations of 2 quarts per 100 gallons.

You may use parathion to kill pear-psylla eggs at this time in place of the DN materials. A concentration of 1 pound of 15 per cent powder in 100 gallons of spray is enough. Parathion appears to be less injurious to the trees and also allows somewhat more leeway in timing the application than the DN materials. Parathion is probably not effective against sooty blotch.

Pre-blossom spray

(When the blossom buds begin to separate in the cluster)

A pre-blossom application is necessary only in orchards where pear scab or pear midge is a problem. For scab control, you may use lime-sulfur 1-50 (2 gallons in 100 gallons of water) or a 2-10-100 bordeaux mixture.

The most effective control for pear midge is 2 pounds of DDT powder to 100 gallons of spray applied when the blossom buds are swollen but before the sepals have begun to separate and again 7 days later. At this time the midge flies are usually "swarming" on the trunks and will readily take flight if disturbed. An alternative method is to add 1 pint of nicotine sulfate to either of the formulas given for the control of scab, and make the application after the flies are out and the sepals on the most advanced buds have separated. If DDT is used and a fungicide is necessary, use elemental sulfur.

Special bloom spray

(When three-fourths of the blooms are open in orchards where fire blight is a problem)

Copper sulfate	2 pounds
Hydrated lime	6 pounds
Water to make	100 gallons
or	
20-80 copper-lime dust	

One application usually is made when three-fourths of the blooms are open; if fire blight has been very severe, you may make an additional early application when about one-fifth of the blossoms are open. The possibility of a reduction of the set of fruit and of fruit russetting by copper applications in bloom should be balanced against the likelihood of blossom infection in deciding whether to apply the material in individual orchards.

The spray application is supplementary to such measures as cutting out or chemical treatment of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit spurs. These control measures are discussed in detail in Cornell Extension Bulletin 405, Fire Blight and Its Control.

Petal-fall spray

(When the last of the petals are falling)

Elemental sulfur at manufacturers' directions

DDT	2 pounds
Water to make	100 gallons

The DDT in the formula is effective against false tarnished plant bug, codling moth, fruit tree leaf roller, and green fruitworms. If plum curculio is a problem, 2 pounds of lead arsenate and 2 pounds of hydrated lime may be added to the DDT.

In orchards where pear psylla is the only problem, you may omit this spray.

You may use bordeaux mixture, 2-10-100, in place of elemental sulfur to control pear scab, and use nicotine sulfate, 1 pint

in 100 gallons of spray, with bordeaux to control false tarnished plant bug. Lead arsenate may be used with bordeaux, but the effect of the DDT would be destroyed.

Do not use DDT if there are any open blossoms.

First-nymph spray

(About a week to ten days after the petals have fallen)

Copper sulfate	2 pounds
Hydrated lime	10 pounds
Lead arsenate	3 pounds
Nicotine sulfate	1 pint
Water to make	100 gallons

An elemental sulfur and 3 pounds of lime may be substituted for the copper sulfate and lime on varieties where russeting has been a problem.

This spray is timed especially for the pear psylla and should be delayed until most of the eggs have been hatched, which normally is about a week after the petals have fallen, but occasionally may be as late as two weeks after petal fall. It furnishes protection also from codling moth, plum curculio, and scab. Where

codling moth and plum curculio are not a problem, the arsenate may be omitted.

You may use any one of the formulas listed under early summer sprays where pear psylla alone is a problem. If you use formula 1 or 2, the elemental sulfur rather than the bordeaux mixture should be included for scab control. If the concentration of parathion is raised to 2 pounds per 100 gallons, codling moth and plum curculio as well as pear psylla will be controlled.

Special spray for rose leaf beetle, quince curculio, and sinuate pear borer

(About June 10; usually necessary only in eastern New York orchards wherever these pests may be a problem)

Lead arsenate	3 pounds
Hydrated lime	3 pounds
Spreader	½ pound
Water to make	100 gallons

If sinuate pear borer is a problem, increase the lead arsenate and lime to 5 pounds each, or add 2 pounds of DDT to the spray mixture.

SUMMER SPRAYS

(When psylla or codling moth becomes threatening)

Early summer sprays

(In July when most of the second-brood psylla eggs have hatched)

At this time you may use any one of three mixtures:

1. Cubé root	2 pounds
(5 per cent rotenone)	
Summer oil	2 quarts
Blood albumin	2 ounces
Water to make	100 gallons
2. Parathion	½ to 1 pound
(15 per cent wettable powder)	
Water to make	100 gallons

3. Copper sulfate	2 pounds
Hydrated lime	10 pounds
Nicotine sulfate....	½ to 1 pint
Water to make	100 gallons

An elemental sulfur and 3 pounds of lime may be substituted for the copper sulfate and lime in formula 3. If scab is a problem, use formula 3.

Excellent control of sooty blotch and of Fabraea leaf and fruit spot may be obtained by the use of 1 pound of ferric dimethylidithiocarbamate (Ferbam) to 100 gallons in the summer sprays.

If codling moth is a problem, you may add 2 pounds of DDT to formula 3 or in-

crease the parathion in formula 2 to 1½ pounds. DDT should not be used with oil because of injury to the foliage and increased toxic residue at harvest time. If codling-moth control is necessary previous to the application to control pear psylla, you may apply DDT as a separate spray at the time worm activity requires it.

Late summer spray

(Early in August if psylla becomes abundant and threatens to smut the fruit or if

the second-brood codling moth is a problem)

Formula 1 or 2 as indicated may be used in this application if psylla is the only problem.

In areas of New York where codling moth is troublesome, you may prevent late injury by using 2 pounds of DDT and ½ pint of nicotine sulfate in 100 gallons of water, or 1½ pounds of parathion alone. This application gives protection also from late infestations of psylla. The spray usually is applied during the first two weeks in August.

CHERRY

UNDER New York conditions, cherries are sprayed principally to control leaf spot, brown rot, and fruit flies. In

some locations the plum curculio may require attention. Black cherry aphid is confined as a pest mostly to sweet cherries.

SPRAY OUTLINE FOR SOUR CHERRIES

Pre-blossom spray

(Just before the blossoms open)

Lime-sulfur	2½ gallons
or	

Elemental sulfur at manufacturers' directions

Water to make 100 gallons

This spray is applied for the control of brown-rot blossom-blight. It is important in most seasons on English Morello, and may be needed in some years on Montmorency cherries.

If dust is used, dusting sulfur is indicated.

Petal-fall spray

(When the last of the petals are falling)

Lime-sulfur	2½ gallons
*Lead arsenate	2½ gallons
Water to make	100 gallons

Elemental-sulfur paste .	10 pounds
--------------------------	-----------

Oil type of sticker	1 pint
Hydrated spray lime ..	2½ pounds
*Lead arsenate	2½ pounds
Water to make	100 gallons

or

Low-soluble copper at manufacturers' directions plus 1 pound of lime for each ¼ pound of metallic copper in the mixture plus 1 pint of oil type sticker. Lead arsenate, *2½ pounds in 100 gallons of spray, is included.

*Lead arsenate should be reduced to 1 pound on English Morellos to reduce arsenical injury ("dry stem").

Stem-end injury to Montmorency fruit, in the form of a black ring, appeared in appreciable amounts in a few orchards that received sprays of low-soluble copper in 1945. Apparently injury is more likely to occur when the copper is used in the shuck and the first fruit-fly spray. There was no injury in the six previous years

from the use of these materials, and leaf-spot control was superior to that with the sulfur sprays. Two organic fungicides that have shown promise as substitutes for low-soluble copper in the shuck and first fruit-fly sprays to prevent fruit injury are 2 heptadecylglyoxaldine (341B) at $1\frac{1}{2}$ to 2 pounds per hundred gallons and ferric dimethylidithiocarbamate (Ferbam) used at $1\frac{1}{2}$ pounds per hundred gallons of spray.

The addition of 1 pound of hydrated lime for each pound of lead arsenate tends to reduce the danger of arsenical injury. The addition of $\frac{1}{2}$ pound of soybean flour improves the spreading qualities of the lime - lead-arsenate mixture. You may use parathion or methoxychlor in place of lead arsenate where curculio is a severe problem as discussed in the peach schedule on page 20. Elemental sulfur should be used with these materials.

This spray is effective against leaf spot, brown rot, and curculio.

Bordeaux mixture at $1\frac{1}{2}$ -6-100 may also be used, but consider the danger of foliage injury and dwarfing of the fruit before you use this highly effective fungicide. Dwarfing of the fruit has followed lime-sulfur applications also. During a four-year test, higher yields were obtained with low-soluble copper and with sulfur paste than with lime-sulfur or bordeaux mixture.

If you follow a dusting schedule, a 90-10 sulfur-lead-arsenate mixture is indicated. If curculio is abundant, an 80-20 mixture of the same materials may be used.

Shuck spray

(When the shucks are falling from the fruits that are going to set)

Follow the same suggestions and materials as those mentioned under petal-fall spray.

This spray is effective against curculio leaf spot, and brown rot.

If you use dust, an 80-20 sulfur-lead-arsenate mixture is indicated.

Later sprays

These later sprays are for cherry fruit flies, leaf spot, and brown rot.

At this point it will be necessary to modify the spray schedule, depending upon the use to which the cherries are to be put: (1) canning cherries that are to be washed or (2) cherries that are to be eaten as fresh fruit.

For canning cherries to be washed

First fruit-fly spray

(A week after the fruit flies have first appeared or about the time Early Richmond first shows a tinge of color)

Use the same materials and suggestions as those given under the petal-fall spray (page 15).

Second fruit-fly spray

(About ten days later than the first fruit-fly spray or when Montmorency begins to color)

Use the same materials and suggestions as those mentioned under the petal-fall spray (page 15).

If you use dust, a 90-10 sulfur-lead-arsenate mixture is indicated. Make the applications at the same times as are indicated for sprays, but, if there are heavy rains, apply extra dusts following them.

After-picking spray

(Soon after harvest)

The choice of fungicides given under the petal-fall spray (page 15) applies for this application. Omit the lead arsenate.

For cherries to be used as fresh fruit

The schedule outlined for the fruit-fly sprays for sweet cherries should be followed.

FOR SWEET CHERRIES

Dormant spray

(Before the buds are open)

The DNC sprays are effective for the control of black cherry aphid. Use 1½ quarts of a liquid or 1½ pounds of a powdered DNC (Elgetol, Krenite, and the like) material in 100 gallons of water.

The newer DNBP materials (DN-289, Elgetol 318) may also be used at the rate of 1 quart in 100 gallons of spray.

Pre-blossom spray

(Just before the blossoms open)

Lime-sulfur	2 gallons
Water to make	100 gallons
OR	
Elemental-sulfur paste .	10 pounds
Oil type of sticker	1 pint

The pre-blossom spray is for the control of brown-rot blossom blight. Additional sulfur applications in bloom may be needed. If you made no dormant spray for aphids, make an application at the green-tip stage, adding 1 pint of nicotine sulfate; from 3 to 5 pounds of potash fish-oil soap, 1 pound of soap flakes, or 3 pounds of spray lime may be substituted for the lime-sulfur to spread and activate the nicotine. From ¼ to ½ pint of TEPP or 1 pound of parathion may be substituted for the nicotine sulfate in the elemental-sulfur formula.

Usually, the nicotine spray is not so effective as the dormant DN sprays for aphid control.

Petal-fall spray

(For leaf spot, brown rot, and plum curculio)

Lime-sulfur	2 gallons
Lead arsenate	2½ pounds
Hydrated spray lime...	2½ pounds
Water to make	100 gallons

Elemental-sulfur paste .	10 pounds
Oil type of sticker	1 pint
Lead arsenate	2½ pounds
Hydrated spray lime ..	2½ pounds
Water to make	100 gallons

The addition of ½ pound of soybean flour improves the spreading qualities of the lime-sulfur-lead-arsenate mixture.

Copper sprays are unsafe for use on sweet cherries.

Parathion or methoxychlor may be used in place of lead arsenate as indicated in the sour cherry schedule (page 16).

Shuck spray

(When the shucks are falling from the fruits which are going to set)

Use the same materials as those outlined for the petal-fall spray.

The shuck spray is effective against leaf spot, brown rot, and curculio.

Later sprays

(For cherry fruit flies, leaf spot, and brown rot)

At this point it will be necessary to modify the spray schedule depending upon the use to which the cherries are to be put: (1) cherries that are to be consumed as fresh fruit or (2) canning cherries that are to be washed.

During the past few years the black cherry aphid has frequently required summer control measures. Either of the following sprays may be used:

- (1) Tetraethyl pyrophosphate ¼ to ½ pint
Water to make.... 100 gallons
- (2) Parathion 1 pound
Water to make.... 100 gallons
- (3) Nicotine sulfate ... 1 pint
Soap chips 1 pound
Water to make.... 100 gallons

For cherries to be used as fresh fruit

It is impossible to recommend a spray schedule that always gives satisfactory maggot control and at the same time insures freedom from spray residue. The following suggestions are offered:

Where arsenicals are used in the fruit-fly sprays

First fruit-fly spray

(*About one week after the fruit flies have first appeared or about the time Early Richmond first shows a tinge of color*)

Lime-sulfur	2 gallons
III	
Elemental-sulfur paste .	10 pounds
Basic zinc arsenate	1 pound
Hydrated lime	1 pound
Spreader	½ pound
Water to make	100 gallons

If dust is used, a 90-10 sulfur-lead-arsenate mixture is indicated. The same precautions should be taken with dusts as with sprays as regards spray residues.

Second fruit-fly spray

(*About ten days after the first fruit-fly spray or when Montmorency begins to color*)

The formula is the same as that for the first fruit-fly spray except that the arsenical and lime are reduced to $\frac{1}{2}$ pound each.

Where non-arsenical sprays are used

First fruit-fly spray

(*About one week after the fruit flies first appear or about the time Early Richmond shows a tinge of color*)

Finely ground derris or cubé powder	2 pounds (containing from 4 to 5 per cent of rotenone)
---	---

Wettable sulfur at manufacturer's directions

Water to make 100 gallons

Do not use lime, bordeaux mixture, or lime-sulfur with derris or cubé powder. The paste forms of wettable sulfurs plus a sticker seem superior for this purpose.

Second fruit-fly spray

(*About one week after the first fruit-fly spray*)

The formula is the same as that for the first fruit-fly spray.

Third fruit-fly spray

(*About one week after the second fruit-fly spray*)

The formula is the same as that for the first fruit-fly spray.

If you prefer to make only two fruit-fly sprays, it is advisable to use 3 pounds of derris or cubé powder to 100 gallons of spray instead of 2 pounds. Two applications may not give so satisfactory control as three, particularly if there are rain periods.

For processed sweet cherries that are to be washed

The schedule is the same as that outlined for sour cherries that are to be washed except that the lime-sulfur is reduced to 2 gallons. Coppers are unsafe for sweet cherries.

After-picking spray

Follow the same schedule as that outlined for sour cherries (page 16) except reduce the lime-sulfur to 2 gallons, and use sulfurs rather than coppers for sweet cherries.

PEACH

IN New York the peach suffers severely from leaf-curl, brown rot, and scab—and, in certain localities, from the ravages

of the plum curculio. The oriental fruit moth has been a major pest of peach, and requires suitable control measures.

SPRAY OUTLINE

Leaf-curl spray

(*After the leaves drop in the fall or in the spring before the buds swell*)

Lime-sulfur	6½ gallons
Water to make	100 gallons

If San José scale is present, 11 gallons of lime-sulfur should be used.

Lime sulfur is the most effective spray material for the control of leaf-curl. The DNC materials are unusually effective when applied in the spring at 2 quarts of the paste or 2 pounds of the powder. Injury to peach buds has been reported from using 1 gallon of Elgetol in late-spring sprays. Bordeaux mixture which has been effective in the past, was ineffective in 1947 tests when applied in the fall of 1946 to trees that had severe curl in 1946. It was less effective than lime-sulfur or the dinitro materials when applied in the spring in the same orchard. Where leaf-curl has not been a problem in the past, satisfactory control may be obtained with 6-6-100 bordeaux mixture.

Do not use the DNBP materials (DN-289 and Elgetol 318) on peaches.

Dormant spray for scale insects

(*In the spring before the buds swell*)

"Superior" type oil ..	2 to 3 gallons
Blood albumin	2 ounces
Water to make	100 gallons

Apply this dormant spray where cottony scale or lecanium scales are present in large numbers. For lecanium scale, 2 gallons of oil is enough, while cottony scale requires 3 gallons in 100 gallons of spray. Experience indicates that most infestations of scale insects can be more easily con-

trolled by summer applications than by a dormant spray.

Pre-blossom spray

(*When the blossoms show pink or a little earlier if a rain period threatens*)

Lime-sulfur	2 gallons
Water to make	100 gallons

OR

Elemental sulfur at manu-	
facturers' directions	
Water to make	100 gallons

This application is made to prevent brown-rot blossom blight.

If a dust schedule is followed, an application of dusting sulfur is indicated.

Shuck spray

(*When the shucks are falling from the fruits that are going to set*)

Elemental sulfur at manu-	
facturers' directions	
Parathion	2 pounds
Water to make	2 gallons

OR

Elemental sulfur at manu-	
facturers' directions	
Methoxychlor	3 pounds
Water to make	100 gallons

This shuck spray is important in the control of plum curculio and brown rot. In the past, 2 pounds of lead arsenate plus corrective have been recommended as a curculio control. Under New York conditions, 16 pounds of hydrated lime has proved most effective as an arsenical corrective. High-calcium and high-magnesium limes are equally effective. Finess and freedom from carbonation are

important in a hydrated lime for arsenical correction. Unless packaged in gas-tight bags, hydrated lime carbonates rapidly. Some growers have replaced the 16 pounds of lime by a mixture of zinc sulfate (8 pounds of crystal, or 7 pounds of flaked or 3 to 5 pounds of monohydrate form) plus 8 pounds of lime. Most growers have replaced lead arsenate with one of the more effective organic compounds for plum curculio control. Two applications or more of lead arsenate can cause serious injury and even one application may be injurious.

For plum curculio, time the shuck application when approximately $\frac{1}{2}$ of the shucks have fallen from the fruit that is to set or when maximum temperatures of 80° F. or higher are forecast. In western New York, a second application of either parathion or methoxychlor is required about 8 days after the shuck application. In eastern New York, three applications will be necessary, one at shuck-fall stage followed by two more at 8-day intervals.

If you use the parathion formula, you will have supplied some protection also against first brood oriental fruit moth, plant bugs, and orchard mites. The methoxychlor formula is of little value except for plum curculio. Benzene hexachloride is not recommended on peaches because of the possibility of resultant off-flavor in the fruit.

In some orchards, tarnished plant bug and stink bugs are of considerable importance. Use DDT at a rate of 2 pounds of 50 per cent wettable powder. If infestations are low to moderate, a single application at early shuck-fall stage should be enough; in heavier infestations, a pre-bloom application may be of considerable benefit followed by the shuck-fall application. If you use parathion for plum curculio control, the DDT will not be necessary at shuck-fall time. A pre-bloom application should only be made where a serious problem exists, because of the harm it may cause to insect pollinators.

SUMMER SPRAYS

If brown rot is the only problem, sulfur sprays or dusts should be applied the first two or three weeks after the shucks have

fallen; the second two or four weeks before the fruit ripens, and a final application just before harvest.

Scale insects

Summer sprays for European fruit lecanium scale and peach cottony scale should be timed during the hatching period of the "crawlers" or young scales. Several programs may be used. The choice of materials and concentrations depends on whether a single-application program or a two-application program is desired.

The period of hatch is usually during late June and early July. Lecanium generally begins hatch a week to ten days later than cottony scale.

Parathion and TEPP may be used with sulfur, but do not apply summer oil with-

in two weeks and preferably within four weeks of a sulfur application. Do not apply summer oil within 2 weeks of DDT.

TABLE 1. *Summer Control Measures for Peach Cottony Scale*

Material	50 per cent hatch	100 per cent hatch
Parathion . . .	$\frac{1}{2}$ pound	$\frac{1}{2}$ pound
Parathion	2 pounds
TEPP . . .	$\frac{1}{4}$ to $\frac{1}{2}$ pint	$\frac{1}{4}$ to $\frac{1}{2}$ pint
Summer oil	1 per cent

TABLE 2. Control Programs for Oriental Fruit Moth

Program	First-brood sprays	Second-brood spray	Third-brood sprays
Program 1	Parathion—2 pounds (Same timing as for plum curculio in shuck fall and subsequent sprays)		DDT 2 pounds (August 1 to 10)
Program 2		DDT 2 pounds (2 applications, July 7 and 10 days later)	DDT 1 pound (August 1 to 10)
Program 3		Parathion, 1½ pounds (2 applications, July 7 and 10 days later)	DDT 2 pounds (August 1 to 10)

Oriental fruit moth

The oriental fruit moth may still be a serious pest of peach. The program was formerly based on applications of DDT alone. Before DDT, orchardists were dependent upon parasites, principally the species *Macrocentrus ancyliavorus* for control. At present, several programs may be used as shown in table 2.

Program 1 is of value against plum curculio and plant bugs as well as oriental fruit moth.

Program 2 is the standard schedule for the control of oriental fruit moth alone.

Program 3 controls scale insects as well as oriental fruit moth, and is of value against orchard mites.

Sulfur may be used with any one of these programs where brown rot is a problem.

Peach tree borers

It is necessary to make separate applications to control peach tree borer. DDT applications at 3 pounds in 100 gallons of spray have proved highly effective. Make two to three applications beginning July 7 to 12 and follow at about 3-week intervals. In some years, the last application is not necessary. Thoroughly cover the trunks and scaffold limbs with spray.

DDT is not effective against the lesser peach tree borer.

During the past two seasons, the use of 2 pounds of parathion in each 100 gallons of spray has shown promise as a combined lesser and regular borer treatment. To insure control of the lesser borer, make an earlier application about June 10 to 20 in addition to the program timed for regular peach tree borer control. Spray the scaffold limbs as well as the trunk to control effectively the lesser borer. You may wish to use this combined treatment on a trial basis during 1951.

Japanese beetle

In the southern part of the Hudson Valley where Japanese-beetle infestations are heavy, fruit may require protection from mid-July to mid-August. Zinc dimethyl-dithiocarbamate (Ziram), 1½ pounds in 100 gallons of water is a good repellent to Japanese beetle and may be substituted in place of the sulfur. Where DDT is to be used to control Oriental fruit moth, Japanese beetle will be adequately controlled on all late varieties. Since the residual effect of DDT sprays is limited to approximately 14 days, the last spray on early maturing varieties may not provide pro-

tection up to the harvest date. If beetles attack the ripening fruit, make a pre-harvest rotenone spray or dust or a spray of zinc-dimethylidithiocarbamate fungicide.

Orchard mites

Orchard mites often become a problem on peaches. Follow control measures discussed under apples (page 9).

PLUM AND PRUNE

THE main troubles for which commercial growers of plums and prunes find spraying necessary are plum curculio, leaf spot, and brown rot. In some plantings, European red mite, apple maggot, and

black knot may require special attention. Occasionally, outbreaks of the lecanium scale necessitate an application of an oil spray in the dormant or summer sprays.

SPRAY OUTLINE

SPRING SPRAYS

Green-tip spray

(As the buds are breaking)

Bordeaux mixture.....	6-12-100
Dormant oils	3 gallons
Water to make	100 gallons
or	
Lime-sulfur	11 gallons
Water to make	100 gallons

If black knot is a serious problem, apply the green-tip spray in addition to the regular shuck and summer sprays on plums and prunes. For the green-tip spray, both bordeaux and lime-sulfur have given good results. The bordeaux-oil mixture at the green-tip stage controls red mite, lecanium scale, San José scale, and black knot, replacing the dormant spray formerly recommended. If you use DDT during the summer to control apple maggot, this green-tip spray is necessary for protection from red mite.

If bud moth is a problem, 1 pint of nicotine sulfate is included in the bordeaux-oil formula above.

One pound of parathion may be used to control bud moth if you omit the oil from the formula, but if, however, you omit the oil, you may need to make suitable control measures for red mite, lecanium scale, and San José scale later where these pests are a problem.

Pre-blossom spray

(Just before the blossoms open)

Lime-sulfur	2 gallons
Water to make	100 gallons
or	
Elemental-sulfur paste .	10 pounds
Oil type sticker	1 pint
Water to make	100 gallons

This pre-blossom spray controls brown-rot blossom-blight.

Shuck spray

(When the shucks are falling from the fruits that are going to set)

Elemental sulfur at manu-	
facturers' directions	
Parathion	2 pounds
Water to make	100 gallons
or	
Elemental sulfur	
Methoxychlor	3 pounds
Water to make	100 gallons
or	
Bordeaux mixture	2-4-100
Lead arsenate	2½ pounds
Water to make	100 gallons

The first formula is effective in checking plum curculio, leaf spot, brown rot, and European red mites. The second formula

is of value for plum curculio, leaf spot, and brown rot. The third formula has been extensively used in the past often with the addition of 1½ gallons of summer oil emulsion to control red mite. The lead arsenate is of some value against plum

curculio but is not so effective as either parathion or methoxychlor. Russetting of the fruit has been severe in some orchards of the Stanley variety, and light to moderate on Fellenburg prunes receiving the bordeaux-oil spray at the shuck-fall in 1946.

SUMMER SPRAY

(The first two or three weeks after the shuck application; the second, two or three weeks before the fruit ripens. Both applications to be made before rain periods)

Elemental sulfur at manu-

facturers' directions

Water to make 100 gallons

The applications control brown rot and leaf spot.

If you follow a dust schedule, applications of dusting sulfur are indicated.

If red mite or two-spotted mite becomes a problem, you may use tetraethyl pyrophosphate at manufacturers' directions or parathion at 1 pound of 15 per cent pow-

der in 100 gallons. Two applications 7–10 days apart are necessary. Summer oil emulsion or DN-111 may be used but late use of oils have a tendency to spot the fruit and DN-111 may cause injury during periods of high temperature, especially in combination with sulfur.

In some orchards, the apple maggot causes considerable damage to prunes. In orchards not surrounded or bordered by unsprayed trees, the maggot may be controlled with three applications of DDT. Applications of DDT, 2 pounds of 50 per cent wettable powder in 100 gallons of water, should be started about June 20 and applied at 10 to 14-day intervals.

QUINCE

FORTUNATELY, the quince is subject to attack by only a comparatively small number of insects and diseases. In the past the most serious insect enemy has been the quince curculio, but the oriental

fruit-moth is now much more destructive. Among diseases subject to control by spraying, the most important is leaf-blight and fruit spot; occasionally the Brooks fruit spot may cause serious losses.

SPRAYING OUTLINE

SPRING SPRAYS

Dormant spray

(In the spring before the buds start)

Dormant-type oil emulsion, diluted to contain 3 per cent of oil.

Apply this when lecanium scale becomes abundant, or for European red mite. (pages 20 and 22) Summer measures as discussed under peaches and prunes may be used if this spray is omitted.

Pink spray

(When the blossoms show pink)

Lime-sulfur 2½ gallons

Water to make 100 gallons

or

3–8–100 bordeaux mixture

or

Ferbam 1½ pounds

or

Elemental sulfur 5 pounds

(actual sulfur)

The lime sulfur gives good control but often causes considerable spray injury. Bordeaux mixture gives excellent control of leaf-blight and fruit spot but severe fruit and leaf injury may occur. Ferbam gives good disease control and causes no spray injury but is somewhat more expensive. Elemental sulfur gives fair control and causes no spray injury.

Petal-fall spray

(When 90 per cent of the petals have started to wither)

Bordeaux mixture 3-8-100
or

Ferbam	1½ pounds
or	
Elemental sulfur	5 pounds (actual sulfur)
DDT	2 pounds
Water to make	100 gallons

This spray controls leaf-blight, leaf spot, codling moth, and oriental fruit moth.

If plum curculio is a problem, add 2 pounds of lead arsenate to the formula.

Lime-sulfur should not be used with DDT. If you use lead arsenate and lime-sulfur, include 1 pound of lime for each pound of lead arsenate.

LATER SPRAYS

The same formula as suggested in the petal-fall spray is advised except that sulfur is not suggested after the petal-fall spray.

Make the first application ten days after the petal-fall spray. This spray controls leaf spot, leaf-blight, and oriental fruit moth. If quince curculio is a problem, add

3 pounds of lead arsenate to the formula.

Two applications after the petal-fall spray are usually enough to control leaf spot, leaf-blight, and quince curculio.

For the control of oriental fruit moth with DDT, from three to four more applications should follow the 10-day spray at 19- to 21-day intervals.

Safety with Insecticides

THE organic phosphate materials, parathion and TEPP, are highly poisonous to man if improperly used. Three deaths in the United States during 1949 resulted from careless handling of parathion. On the other hand, more than a billion gallons of parathion spray was applied without trouble. From studies made of these deaths, the following precautions have been suggested:

1. The greatest danger from parathion wettable powder appears to be in the operation of putting the wettable powder from the bag or can into the spray tank. Be careful at this point.
2. Wear a respirator with a filter for powders and an activated charcoal filter for organic vapors.
3. Wear natural rubber gloves.
4. Protect the body from wettable pow-

der and from spray drift. Wear rubber or plastic coats or wash your clothes frequently.

5. Symptoms of poisoning: headache, nausea, pin-point vision, constriction of the chest.
6. If the above symptoms are experienced, do not delay — see your doctor. The antidote is atropine sulphate and cannot be obtained without a doctor's prescription.
7. Never thin and remove suckers until several days after parathion applications. Handling insecticides safely is similar to driving an automobile or, handling fire. If certain precautions are followed, these useful instruments and materials can be used to advantage. If misused, they can do serious harm.